




**FACULTY OF ENGINEERING
CHULALONGKORN UNIVERSITY
FIRE SAFETY RESEARCH CENTER**



- TYPE OF TEST** : DETERMINATION OF THE FIRE RESISTANCE OF NON-LOADBEARING ELEMENTS OF CONSTRUCTION
- TEST SPECIMEN** : **Steel Fireproof Door with Glass Vision Size 1250 x 2130 mm**
Door Series: SFD2 (For Bumrungrad International Hospital Project)
The specimen is a doorset consisting of a single-sided steel door leaf with a vision panel and a steel door frame. The dimensions of the door leaf are 1172 mm x 2087 mm x 45 mm. The door leaf has a fixed 150 mm x 400 mm FireLite Glass Ceramic (5 mm) vision panel located at the height of 1300 mm measured from its lower edge. The door leaf is constructed of 1.6-mm thick cold rolled steel sheets filled with rock wool with a density of 100 kg/m³. The specimen was mounted on a 15-cm thick reinforced concrete wall, which was installed on a 3 m x 3 m testing frame. The door leaf was locked with the door frame by a panic bar with mortise exit lock and five stainless steel hinges. Intumescent fire seal was installed around the inner perimeter of the door frame. The details of the specimen are shown in Appendix C. The specimen was provided and installed by the client.
- CLIENT** : **SUPA RICH CO., LTD.-VIEWTEX CO., LTD.**
FOR BUMRUNGRAD HOSPITAL PCL.
33 Sukhumvit 3 (Soi Nana Nua)
Wattana, Bangkok 10110, Thailand
- DATE OF TEST** : June 23, 2020
- TEST MACHINE** : Large-scale vertical furnace (Fire Tester III) at the Fire Safety Research Center (FSRC), Department of Civil Engineering, Chulalongkorn University (Thailand). The furnace is capable of producing a standard temperature-time relationship according to BS 476 Part 20: 1987.
- TEST METHOD** : The testing procedures follow the British Standard BS 476: Fire tests on building materials and structures
BS 476 Part 20: 1987: Method for determination of the fire resistance of elements of construction (general principles)
BS 476 Part 22: 1987: Methods for determination of the fire resistance of non-loadbearing elements of construction Section 6: Determination of the fire resistance of fully insulated doorsets and shutter assemblies.
- TEST RESULTS** : The non-loadbearing element of construction described above has the fire resistance of each criterion for the period stated:
(The test results are good only for the specimen tested.)

Criteria	Fire Resistance (hr:min)	Remarks
Insulation	0:18	The average temperature of the unexposed face of the specimen exceeded 140°C above its initial value of 33°C.
Integrity	3:21	Sustained flaming on the unexposed face of the specimen for a period of more than 10 seconds.

Tested by: 
(Professor Dr. Suched Likitlersuang)

Date: July 7, 2020

Checked by: 
(Professor Dr. Thanyawat Pothisiri)

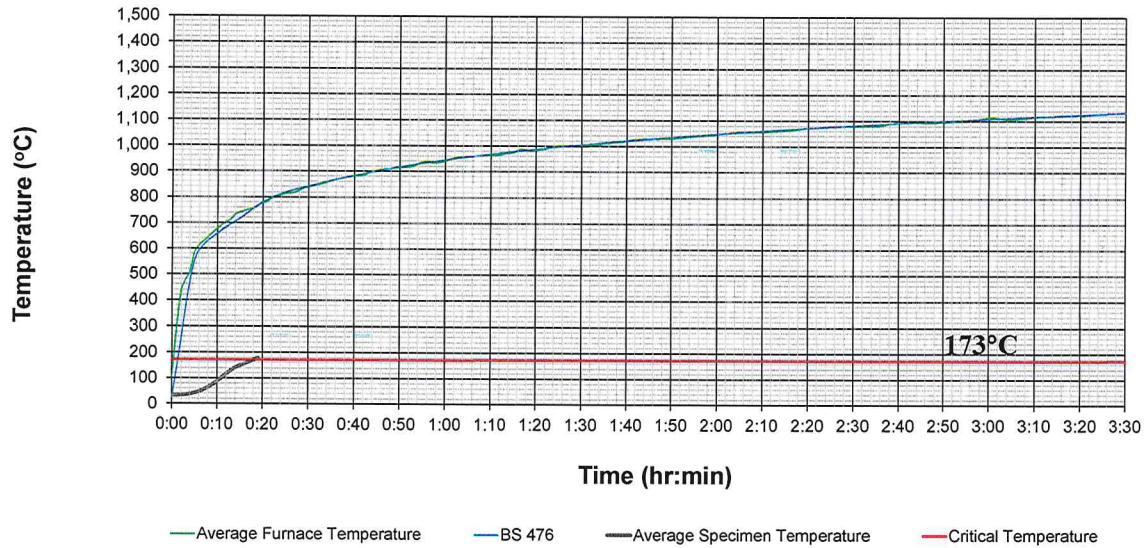
.....
(Associate Prof. Dr. Tirawat Boonyatee)
On Behalf of Head of Civil Engineering Department




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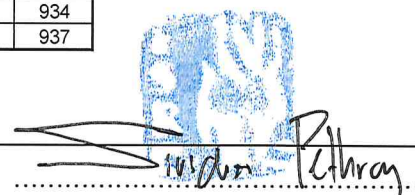
FURNACE TEMPERATURE




(Mr. Sirichai Pethrung)
Authorized Testing Officer


APPENDIX A: TEMPERATURE OF THE FURNACE AND THE SPECIMEN

Time (hr:min:sec)	Furnace Temperature(°C)										Time (hr:min:sec)	BS 476 (°C)
	P1	P2	P3	P4	P5	P6	P7	P8	P9	Average		
0:00:00	140	78	69	126	56	53	140	125	68	95	0:00	20
0:01:00	304	215	385	363	122	105	411	347	369	291	0:05	556
0:02:00	423	423	540	429	264	338	511	475	509	435	0:10	659
0:03:00	450	487	554	467	439	386	569	492	487	481	0:15	718
0:04:00	493	506	571	489	496	418	581	534	508	511	0:20	781
0:05:00	573	598	667	548	542	524	615	613	604	587	0:25	821
0:06:00	599	654	653	577	600	570	622	638	614	614	0:30	842
0:07:00	621	663	675	591	615	586	628	657	629	629	0:35	865
0:08:00	641	675	689	610	627	608	641	670	646	645	0:40	885
0:09:00	656	687	701	635	642	628	664	687	661	662	0:45	902
0:10:00	673	707	723	648	658	643	673	700	676	678	0:50	918
0:11:00	688	725	742	663	672	662	686	712	689	693	0:55	932
0:12:00	703	733	750	674	685	678	698	721	701	705	1:00	945
0:13:00	713	740	751	686	696	692	707	728	709	714	1:05	957
0:14:00	728	761	780	707	710	715	726	746	731	734	1:10	968
0:15:00	739	769	791	714	721	722	736	754	732	742	1:15	979
0:16:00	743	778	790	718	728	728	741	761	744	748	1:20	988
0:17:00	752	780	797	724	733	732	744	767	749	753	1:25	997
0:18:00	755	788	798	732	738	740	750	771	753	758	1:30	1006
0:19:00	765	797	811	746	750	753	769	784	768	771	1:35	1014
0:20:00	775	799	821	752	755	761	774	790	774	778	1:40	1022
0:21:00	778	808	826	757	762	770	781	795	782	784	1:45	1029
0:22:00	791	815	838	773	773	778	799	815	796	798	1:50	1036
0:23:00	796	821	840	779	782	788	808	821	800	804	1:55	1043
0:24:00	801	824	849	785	786	792	814	826	802	809	2:00	1049
0:25:00	806	829	854	793	792	796	818	830	810	814	2:05	1055
0:26:00	810	831	856	795	795	801	821	833	811	817	2:10	1061
0:27:00	814	833	853	800	800	802	822	836	820	820	2:15	1067
0:28:00	820	841	865	806	806	811	833	848	827	828	2:20	1072
0:29:00	828	850	874	815	814	819	844	855	830	837	2:25	1077
0:30:00	831	855	874	819	819	826	847	858	838	841	2:30	1082
0:31:00	838	859	878	824	825	827	851	863	849	846	2:35	1087
0:32:00	838	862	882	828	827	831	855	865	843	848	2:40	1092
0:33:00	842	865	885	829	830	834	857	869	851	851	2:45	1097
0:34:00	849	868	891	837	836	842	868	877	858	858	2:50	1101
0:35:00	854	875	900	844	843	850	871	885	865	865	2:55	1106
0:36:00	858	881	903	849	850	854	878	888	868	870	3:00	1110
0:37:00	866	880	908	853	853	854	879	891	874	873	3:05	1114
0:38:00	869	885	910	856	858	861	882	896	881	878	3:10	1118
0:39:00	870	889	916	860	860	862	886	898	876	880	3:15	1122
0:40:00	876	891	919	865	863	866	886	900	883	883	3:20	1126
0:41:00	873	895	910	864	864	870	894	903	886	884	3:25	1129
0:42:00	876	897	917	865	866	871	895	903	882	886	3:30	1133
0:43:00	882	900	927	873	870	877	901	912	894	893		
0:44:00	891	907	931	880	881	883	911	920	897	900		
0:45:00	894	915	937	885	886	891	918	925	903	906		
0:46:00	898	915	939	890	889	893	922	929	905	909		
0:47:00	899	919	936	892	893	894	922	931	907	910		
0:48:00	899	920	940	893	893	896	922	932	906	911		
0:49:00	905	916	940	896	895	896	925	932	915	913		
0:50:00	903	920	943	896	896	898	926	935	912	914		
0:51:00	905	918	939	898	897	899	928	937	915	915		
0:52:00	910	921	947	898	899	903	925	938	913	917		
0:53:00	910	930	947	901	902	904	932	939	921	921		
0:54:00	917	933	953	912	910	915	946	950	934	930		
0:55:00	924	941	964	920	917	921	952	955	936	937		
0:56:00	927	941	964	922	923	923	955	963	944	940		
0:57:00	923	941	958	917	919	918	947	955	929	934		
0:58:00	922	936	960	918	917	918	946	955	935	934		
0:59:00	925	942	961	920	919	923	949	956	935	937		

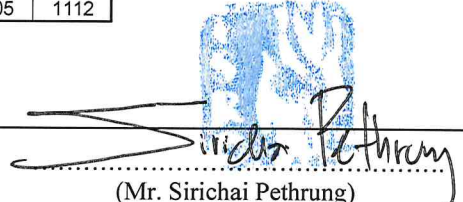


(Mr. Sirichai Pethrung)
Authorized Testing Officer

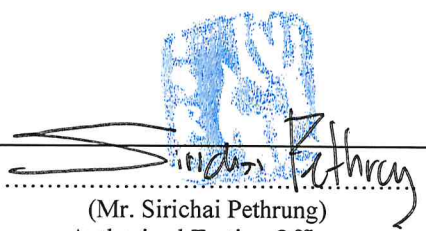
Time (hr:min:sec)	Furnace Temperature(°C)									
	P1	P2	P3	P4	P5	P6	P7	P8	P9	Average
1:00:00	930	945	967	924	922	925	954	960	943	941
1:01:00	937	951	970	931	930	933	964	969	952	949
1:02:00	940	955	975	937	936	937	969	974	958	953
1:03:00	944	957	982	940	940	940	973	978	953	956
1:04:00	944	957	977	940	942	940	971	981	964	957
1:05:00	946	961	978	944	943	943	976	982	962	959
1:06:00	949	961	980	945	944	944	977	982	957	960
1:07:00	947	961	979	947	945	945	978	984	968	962
1:08:00	952	963	981	948	947	946	980	984	966	963
1:09:00	951	963	982	947	948	948	981	986	967	964
1:10:00	953	965	985	949	948	947	981	985	970	965
1:11:00	954	966	985	950	949	948	981	987	965	965
1:12:00	956	967	982	953	951	953	984	986	960	966
1:13:00	955	969	989	955	952	953	985	991	971	969
1:14:00	962	971	995	956	956	958	988	992	974	972
1:15:00	962	978	998	960	959	959	989	993	975	975
1:16:00	969	982	1002	969	965	969	1003	1005	988	984
1:17:00	977	989	1009	975	974	974	1007	1009	993	990
1:18:00	973	984	1005	971	971	969	997	1004	984	984
1:19:00	969	982	1003	968	967	967	998	1000	982	982
1:20:00	973	985	1006	969	968	969	998	1002	984	984
1:21:00	974	988	1008	972	971	974	1002	1005	990	987
1:22:00	977	990	1008	974	972	975	1005	1006	989	988
1:23:00	980	994	1016	979	978	981	1012	1014	995	994
1:24:00	985	997	1020	983	984	985	1013	1019	1002	999
1:25:00	990	1000	1019	988	988	987	1018	1023	1009	1002
1:26:00	991	1000	1020	988	989	987	1020	1023	1004	1002
1:27:00	991	1000	1019	990	989	990	1023	1022	1002	1003
1:28:00	992	997	1018	990	990	986	1021	1023	1010	1003
1:29:00	990	998	1018	988	989	987	1021	1025	1000	1002
1:30:00	989	998	1014	988	988	988	1022	1024	1005	1002
1:31:00	991	997	1021	990	988	987	1021	1024	1000	1002
1:32:00	992	999	1022	991	991	990	1023	1026	1003	1004
1:33:00	994	1001	1023	994	992	992	1025	1027	1010	1006
1:34:00	997	986	1029	996	994	998	1026	1028	1004	1006
1:35:00	1003	991	1034	999	1000	1003	1031	1031	1010	1011
1:36:00	1003	991	1036	1001	1002	1004	1030	1032	1014	1013
1:37:00	1007	993	1038	1002	1003	1006	1032	1036	1019	1015
1:38:00	1007	995	1036	1004	1006	1006	1034	1038	1020	1016
1:39:00	1008	995	1034	1007	1008	1009	1039	1037	1016	1017
1:40:00	1014	1001	1048	1011	1011	1013	1038	1041	1023	1022
1:41:00	1019	1005	1045	1013	1014	1019	1044	1045	1025	1025
1:42:00	1020	1006	1049	1017	1018	1020	1045	1048	1026	1028
1:43:00	1019	1006	1055	1017	1018	1020	1044	1047	1029	1028
1:44:00	1023	1006	1050	1017	1019	1019	1045	1050	1035	1029
1:45:00	1021	1006	1046	1019	1018	1021	1047	1049	1032	1029
1:46:00	1022	1005	1052	1018	1020	1020	1046	1049	1034	1030
1:47:00	1022	1008	1050	1018	1020	1022	1047	1048	1025	1029
1:48:00	1024	1006	1052	1019	1020	1021	1048	1050	1033	1030
1:49:00	1024	1007	1052	1019	1020	1021	1048	1049	1034	1030
1:50:00	1023	1008	1052	1020	1021	1022	1048	1051	1029	1030
1:51:00	1026	1009	1054	1022	1022	1025	1050	1052	1035	1033
1:52:00	1026	1011	1059	1023	1024	1027	1051	1054	1034	1034
1:53:00	1029	1014	1060	1027	1027	1030	1054	1055	1037	1037
1:54:00	1031	1015	1062	1029	1029	1031	1055	1056	1036	1038
1:55:00	1032	1017	1062	1029	1030	1032	1057	1058	1041	1040
1:56:00	1035	1019	1065	1031	1032	1036	1059	1061	1040	1042
1:57:00	1037	1020	1062	1033	1035	1037	1062	1060	1037	1042
1:58:00	1037	1022	1068	1036	1036	1039	1062	1063	1039	1045
1:59:00	1039	1023	1068	1036	1037	1040	1063	1064	1038	1045


 (Mr. Sirichai Pethrung)
 Authorized Testing Officer

Time (hr.min:sec)	Furnace Temperature(°C)									Average
	P1	P2	P3	P4	P5	P6	P7	P8	P9	
2:00:00	1041	1026	1072	1039	1038	1040	1067	1067	1048	1048
2:01:00	1043	1026	1074	1039	1042	1044	1068	1070	1046	1050
2:02:00	1046	1029	1075	1043	1044	1047	1070	1070	1050	1053
2:03:00	1047	1029	1075	1045	1046	1048	1073	1074	1051	1054
2:04:00	1049	1032	1079	1046	1048	1049	1074	1075	1051	1056
2:05:00	1050	1034	1080	1046	1049	1051	1075	1077	1057	1058
2:06:00	1050	1032	1075	1046	1048	1049	1075	1075	1054	1056
2:07:00	1049	1032	1075	1047	1048	1048	1076	1075	1057	1056
2:08:00	1049	1031	1076	1047	1048	1049	1076	1077	1056	1057
2:09:00	1051	1032	1076	1048	1049	1049	1077	1077	1058	1057
2:10:00	1049	1032	1078	1048	1049	1050	1076	1078	1050	1056
2:11:00	1052	1032	1079	1049	1049	1051	1076	1077	1049	1057
2:12:00	1053	1034	1080	1050	1050	1052	1078	1078	1059	1059
2:13:00	1053	1036	1077	1051	1053	1055	1080	1078	1059	1060
2:14:00	1054	1037	1086	1052	1054	1055	1079	1080	1055	1061
2:15:00	1056	1039	1086	1053	1055	1056	1081	1080	1060	1063
2:16:00	1057	1040	1087	1055	1055	1059	1082	1082	1057	1064
2:17:00	1060	1043	1087	1057	1058	1059	1083	1083	1062	1066
2:18:00	1061	1043	1088	1059	1061	1064	1087	1085	1059	1067
2:19:00	1064	1045	1092	1062	1063	1066	1089	1091	1067	1071
2:20:00	1064	1047	1093	1064	1065	1066	1091	1092	1068	1072
2:21:00	1066	1048	1091	1064	1066	1068	1093	1090	1069	1073
2:22:00	1068	1049	1097	1065	1067	1069	1092	1093	1067	1074
2:23:00	1069	1050	1097	1066	1068	1070	1093	1093	1067	1075
2:24:00	1070	1049	1098	1067	1070	1072	1094	1094	1073	1076
2:25:00	1070	1051	1100	1069	1070	1072	1096	1096	1074	1077
2:26:00	1071	1052	1102	1070	1071	1072	1098	1097	1070	1078
2:27:00	1072	1053	1099	1070	1073	1075	1097	1097	1075	1079
2:28:00	1073	1054	1099	1071	1073	1076	1098	1098	1079	1080
2:29:00	1075	1054	1105	1070	1073	1074	1096	1098	1083	1081
2:30:00	1074	1054	1103	1071	1074	1075	1098	1099	1075	1080
2:31:00	1074	1055	1101	1072	1075	1076	1100	1099	1074	1081
2:32:00	1076	1055	1104	1072	1075	1075	1099	1099	1079	1081
2:33:00	1076	1054	1099	1073	1075	1076	1100	1099	1079	1081
2:34:00	1076	1055	1102	1073	1076	1076	1097	1100	1078	1081
2:35:00	1076	1054	1100	1072	1076	1077	1100	1098	1079	1081
2:36:00	1078	1054	1104	1075	1077	1077	1100	1101	1078	1083
2:37:00	1081	1059	1107	1080	1082	1084	1108	1106	1081	1087
2:38:00	1084	1063	1111	1082	1085	1087	1111	1110	1080	1090
2:39:00	1086	1063	1113	1084	1086	1088	1113	1109	1088	1092
2:40:00	1089	1065	1114	1086	1088	1091	1114	1111	1084	1093
2:41:00	1090	1066	1117	1086	1090	1090	1109	1114	1087	1094
2:42:00	1090	1067	1114	1087	1090	1091	1117	1114	1093	1096
2:43:00	1090	1067	1117	1088	1090	1092	1115	1114	1084	1095
2:44:00	1089	1065	1112	1089	1090	1090	1116	1115	1093	1095
2:45:00	1088	1064	1110	1086	1089	1087	1115	1115	1094	1094
2:46:00	1088	1063	1112	1087	1088	1087	1113	1112	1090	1093
2:47:00	1089	1063	1111	1086	1088	1089	1114	1112	1087	1093
2:48:00	1088	1065	1114	1087	1089	1089	1112	1113	1089	1094
2:49:00	1091	1065	1115	1089	1090	1091	1115	1113	1091	1096
2:50:00	1092	1067	1115	1089	1092	1093	1117	1114	1087	1096
2:51:00	1092	1068	1116	1090	1093	1094	1118	1114	1085	1097
2:52:00	1094	1070	1118	1093	1094	1094	1120	1117	1085	1098
2:53:00	1095	1070	1120	1094	1096	1097	1121	1119	1097	1101
2:54:00	1098	1074	1123	1094	1098	1099	1121	1120	1095	1102
2:55:00	1099	1073	1118	1096	1099	1101	1124	1121	1096	1103
2:56:00	1101	1075	1124	1097	1100	1102	1123	1121	1098	1104
2:57:00	1100	1076	1127	1098	1101	1102	1125	1124	1093	1105
2:58:00	1103	1078	1128	1103	1105	1105	1131	1129	1099	1109
2:59:00	1106	1081	1127	1106	1109	1111	1135	1131	1105	1112

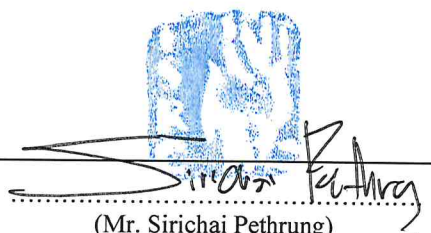

 (Mr. Sirichai Pethrung)
 Authorized Testing Officer

Time (hr:min:sec)	Furnace Temperature(°C)									
	P1	P2	P3	P4	P5	P6	P7	P8	P9	Average
3:00:00	1108	1085	1131	1107	1112	1112	1136	1134	1108	1115
3:01:00	1110	1082	1133	1107	1110	1111	1136	1134	1107	1114
3:02:00	1109	1082	1131	1107	1110	1110	1135	1133	1107	1114
3:03:00	1106	1081	1130	1104	1107	1106	1130	1129	1098	1110
3:04:00	1104	1078	1122	1102	1105	1105	1129	1127	1096	1108
3:05:00	1103	1076	1127	1102	1104	1104	1128	1127	1096	1107
3:06:00	1105	1077	1128	1102	1105	1105	1127	1127	1101	1109
3:07:00	1106	1079	1128	1105	1106	1107	1130	1127	1100	1110
3:08:00	1108	1080	1131	1106	1108	1109	1131	1129	1098	1111
3:09:00	1110	1083	1133	1110	1112	1113	1137	1133	1102	1115
3:10:00	1112	1085	1138	1111	1114	1113	1139	1137	1107	1117
3:11:00	1113	1086	1137	1113	1116	1116	1139	1137	1113	1119
3:12:00	1115	1088	1138	1115	1117	1117	1138	1138	1110	1119
3:13:00	1116	1087	1136	1113	1118	1117	1139	1136	1111	1119
3:14:00	1115	1088	1135	1113	1118	1120	1141	1139	1104	1119
3:15:00	1118	1089	1138	1117	1120	1121	1145	1142	1109	1122
3:16:00	1119	1090	1140	1118	1121	1122	1145	1142	1111	1123
3:17:00	1120	1091	1141	1120	1122	1122	1146	1143	1108	1124
3:18:00	1120	1092	1135	1119	1123	1123	1147	1144	1107	1123
3:19:00	1121	1093	1140	1120	1123	1124	1149	1145	1111	1125
3:20:00	1124	1092	1144	1120	1124	1123	1148	1146	1108	1125
3:21:00	1117	1090	1142	1116	1121	1118	1142	1140	1109	1122



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Time (hr:min:sec)	Specimen Temperature(°C)											Max. (A-I)	Average (A-E)
	A	B	C	D	E	F	G	H	I	J			
0:00:00	33	34	33	32	32	33	33	32	33	33	34	33	
0:01:00	33	34	33	32	32	35	33	33	33	35	35	33	
0:02:00	34	35	34	32	33	37	33	34	35	38	37	33	
0:03:00	35	38	35	33	33	41	34	37	38	43	41	35	
0:04:00	37	42	38	34	35	57	35	42	43	48	57	37	
0:05:00	41	48	44	37	39	89	38	48	48	60	89	42	
0:06:00	46	56	51	41	44	99	41	57	60	80	99	47	
0:07:00	53	65	61	46	50	101	45	87	80	93	101	55	
0:08:00	61	77	73	52	59	112	51	98	93	98	112	64	
0:09:00	70	91	86	59	68	126	59	99	98	102	126	75	
0:10:00	81	106	102	68	81	136	68	104	102	106	136	88	
0:11:00	94	123	119	78	96	142	78	110	111	114	142	102	
0:12:00	108	140	135	91	113	145	85	109	111	114	145	117	
0:13:00	121	146	148	104	130	150	91	118	114	118	150	129	
0:14:00	132	151	157	117	146	156	98	125	118	121	157	141	
0:15:00	140	160	152	130	161	160	102	131	121	123	161	149	
0:16:00	147	168	152	143	168	165	106	136	123	123	168	156	
0:17:00	155	173	157	152	177	171	113	142	123	125	177	163	
0:18:00	164	176	166	161	188	175	123	148	125	125	188	171	
0:19:00	173	180	174	170	198	180	131	154	125	126	198	179	



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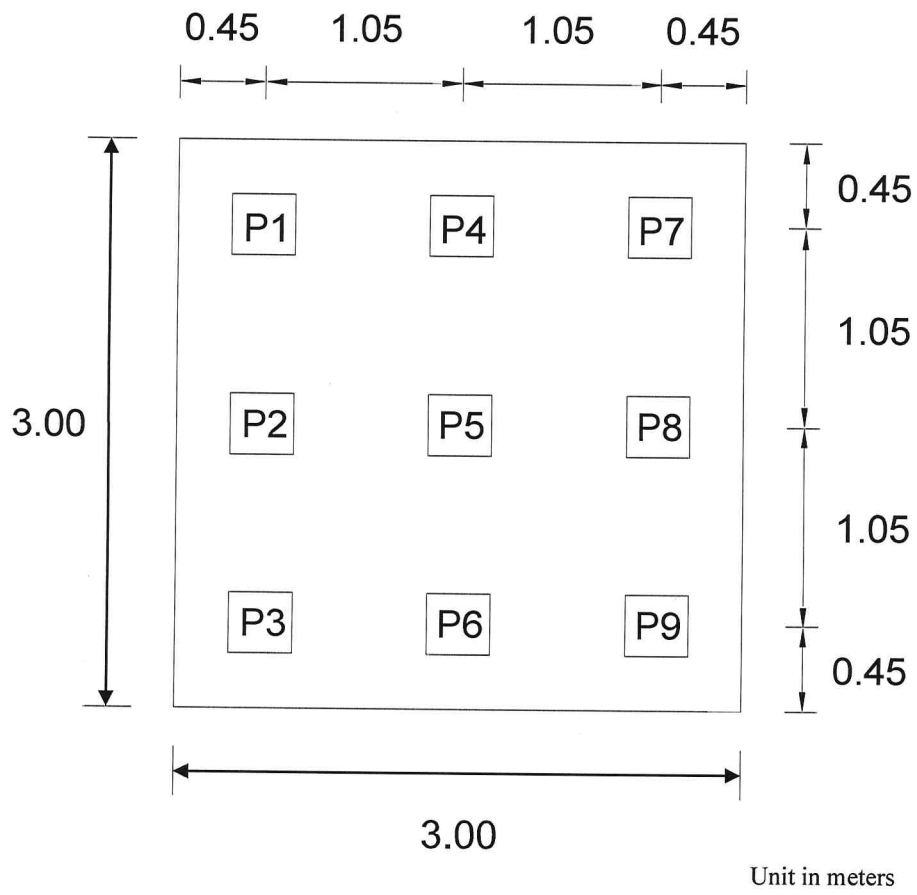


Figure A-1: Location of thermocouples inside the furnace



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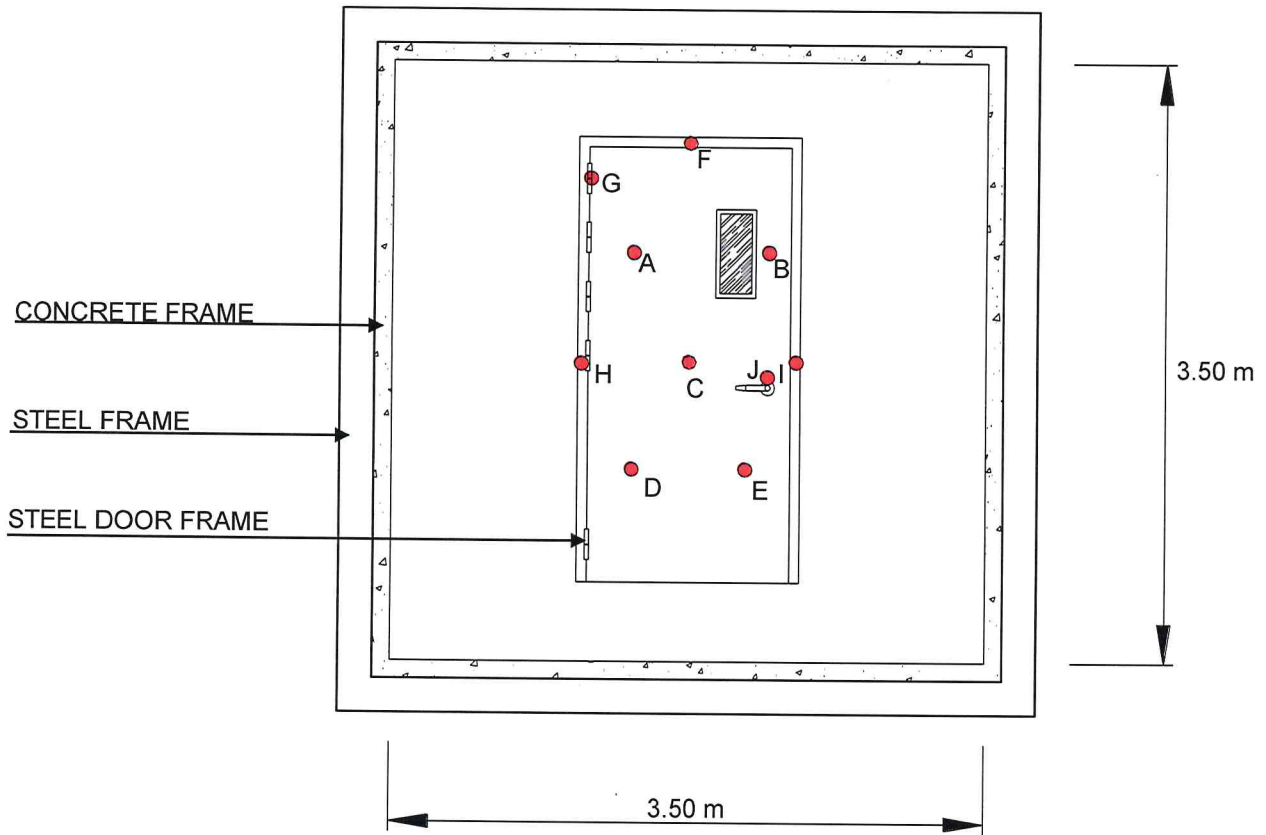
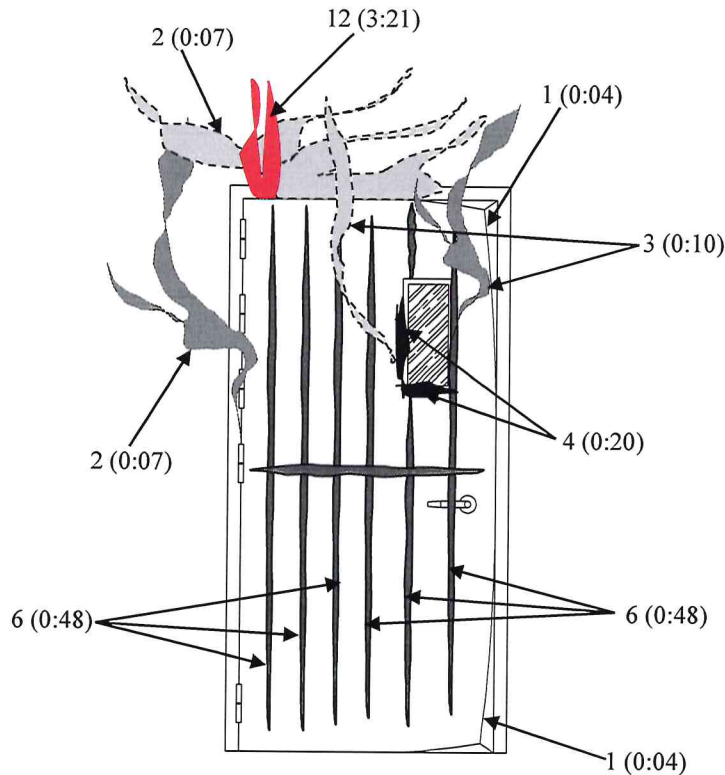


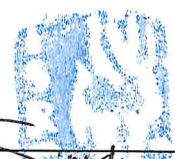

Figure A-2: Location of thermocouples on the specimen


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APPENDIX B: OBSERVATIONS

No.	Time (hr:min)	Observations
1	0:04	The door leaf deflected outward at the upper and lower right corners.
2	0:07	Smoke leaking from the upper edge and the left edge of the door.
3	0:10	Smoke leaking from the vision panel.
4	0:20	Multiple dark areas were observed on the unexposed face of the door.
5	0:30	No significant change was observed.
6	0:48	Multiple dark areas were observed on the unexposed face of the door.
7	1:00	No significant change was observed.
8	1:30	No significant change was observed.
9	2:00	No significant change was observed.
10	2:30	No significant change was observed.
11	3:00	No significant change was observed.
12	3:21	Sustained flaming on the unexposed face of the specimen for a period of more than 10 seconds.





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APPENDIX C: DRAWINGS & DETAILS OF THE SPECIMEN

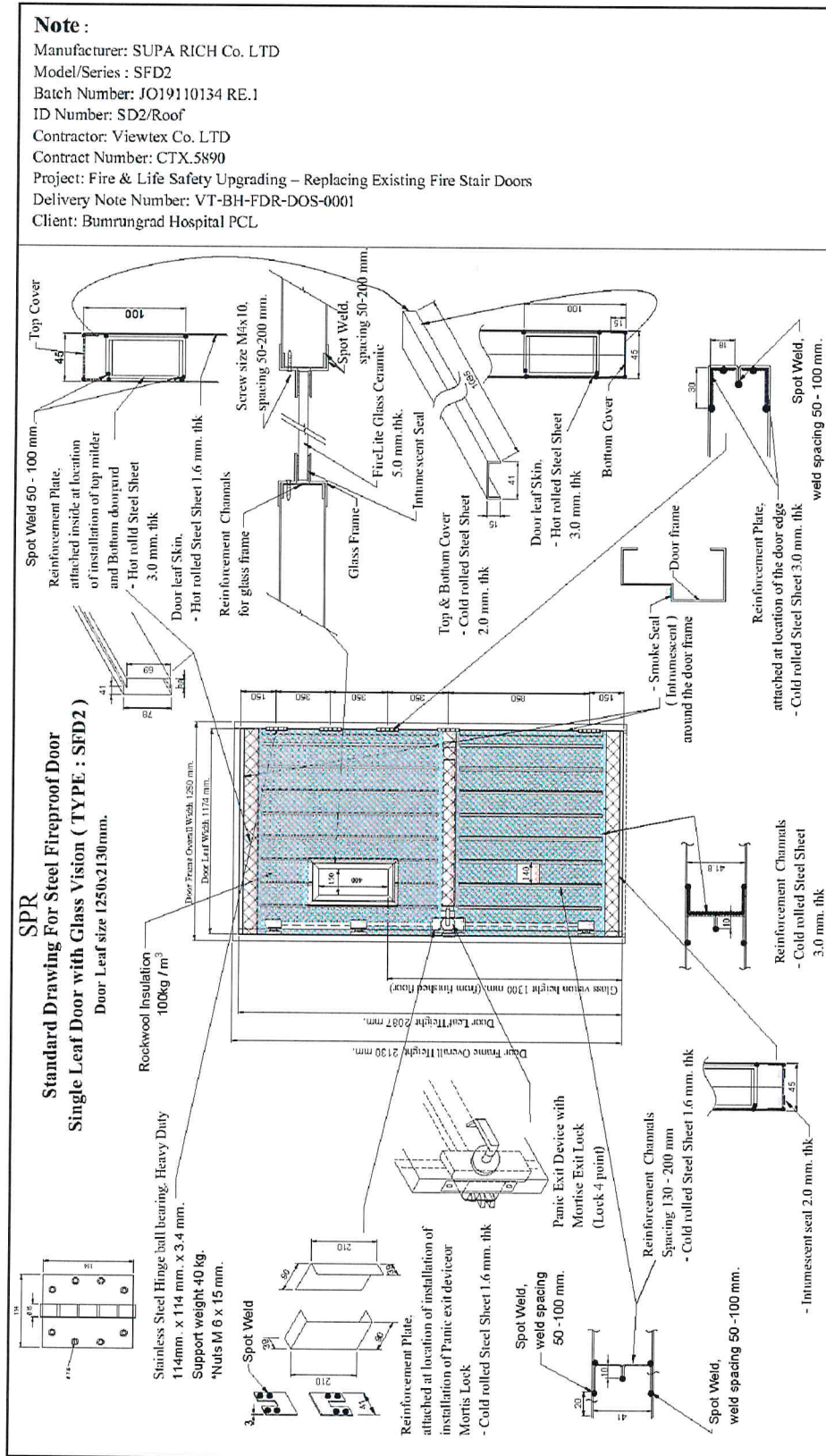


Figure C-1: Details of the specimen (as provided by the client)

(Signature)
 (Mr. Sirichai Pethrung)
 Authorized Testing Officer

APPENDIX D: PHOTOGRAPHS

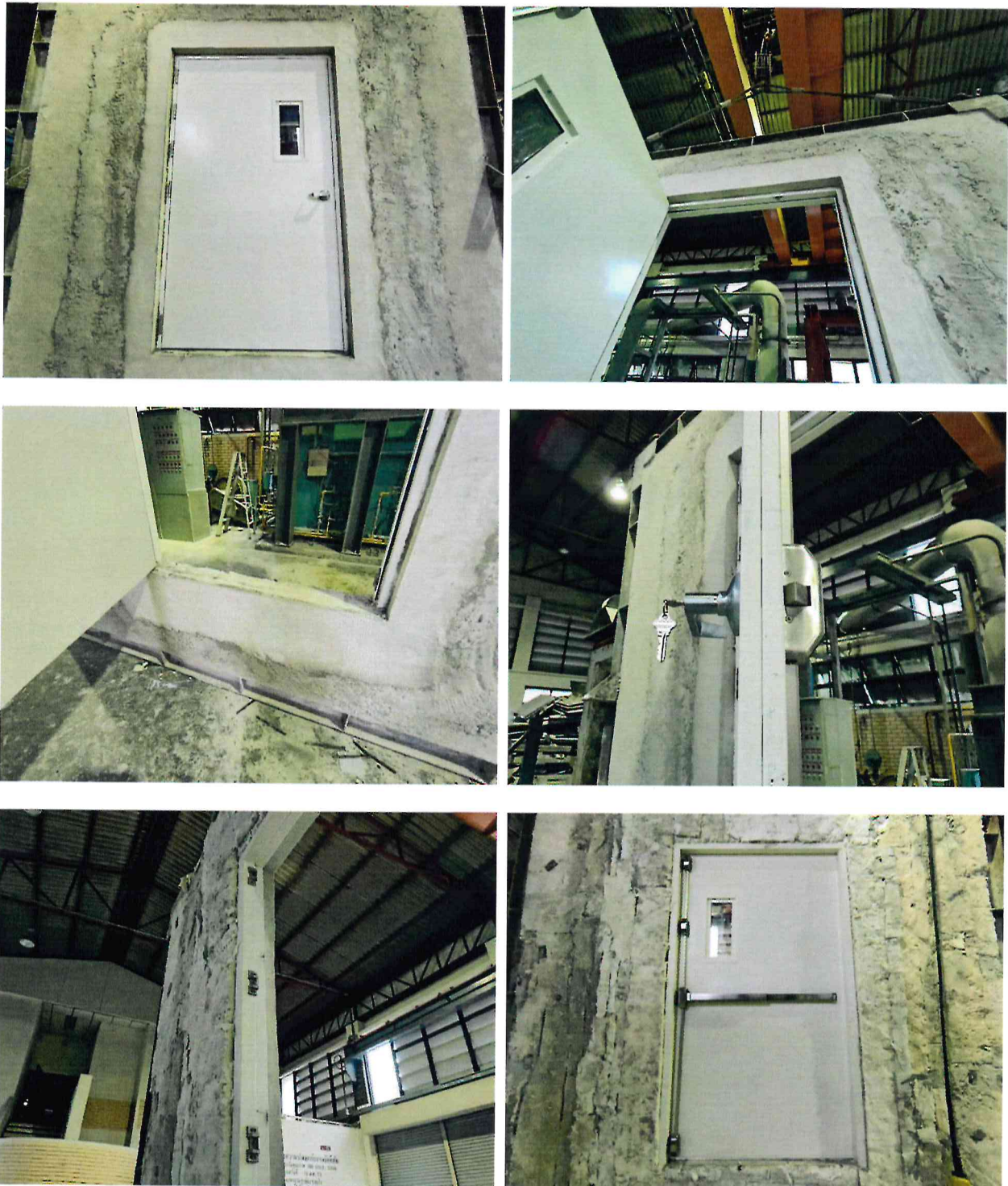



Figure D-1: Specimen preparation prior to the test


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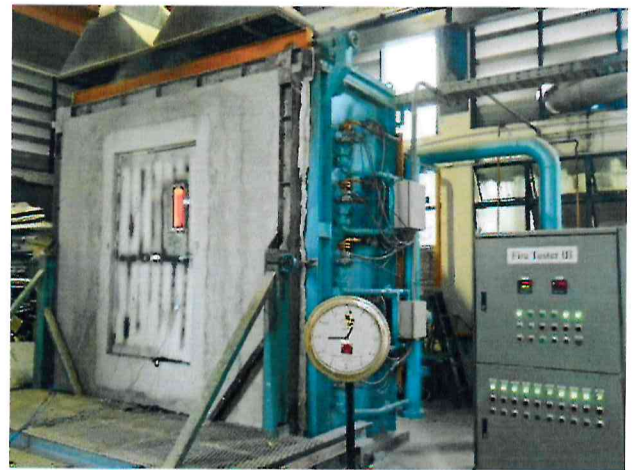
(a) 0:00 hr



(b) 0:15 hr



(c) 0:30 hr



(d) 0:45 hr



(e) 1:00 hr



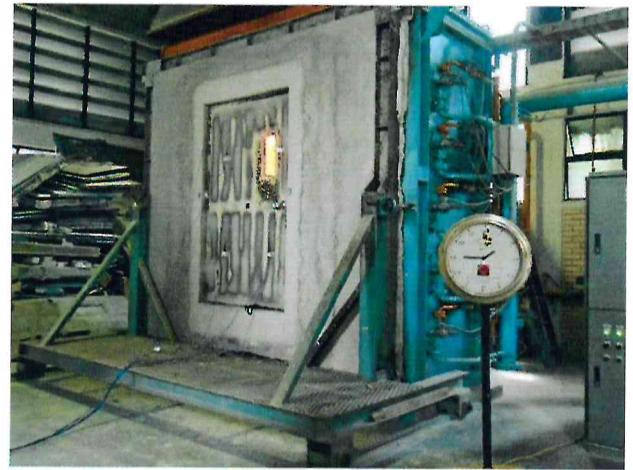
(f) 1:15 hr

Figure D-2: The specimen during the test


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(g) 1:30 hr



(h) 1:45 hr



(i) 2:00 hr



(j) 2:15 hr

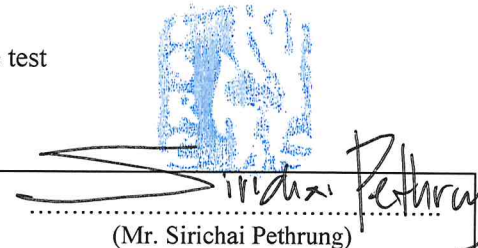


(k) 2:30 hr



(l) 2:45 hr

Figure D-2 (continued): The specimen during the test


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(m) 3:00 hr



(n) 3:21 hr

Figure D-2 (continued): The specimen during the test


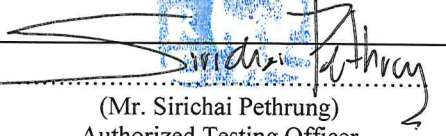

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Figure D-3: The specimen after the test


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